Clean Version

Amended Drawings

Forward to: Official Draftsperson

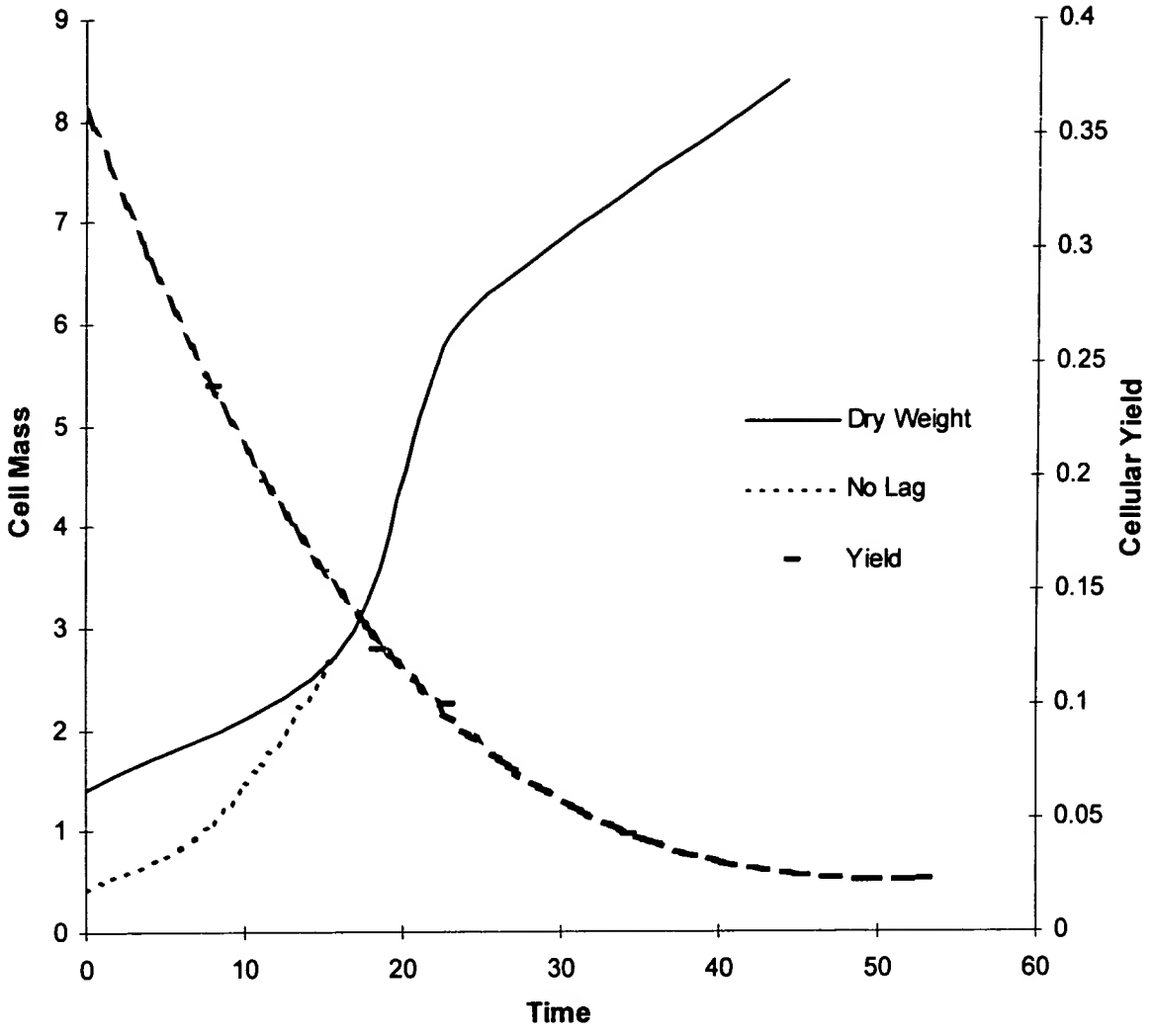

Cell Mass
Cellular Yield
Time
Dry Weight
No Lag
Yield
0
1
2
3
4
5
6
7
8
9
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0
10
20
30
40
50
60

FIG.1

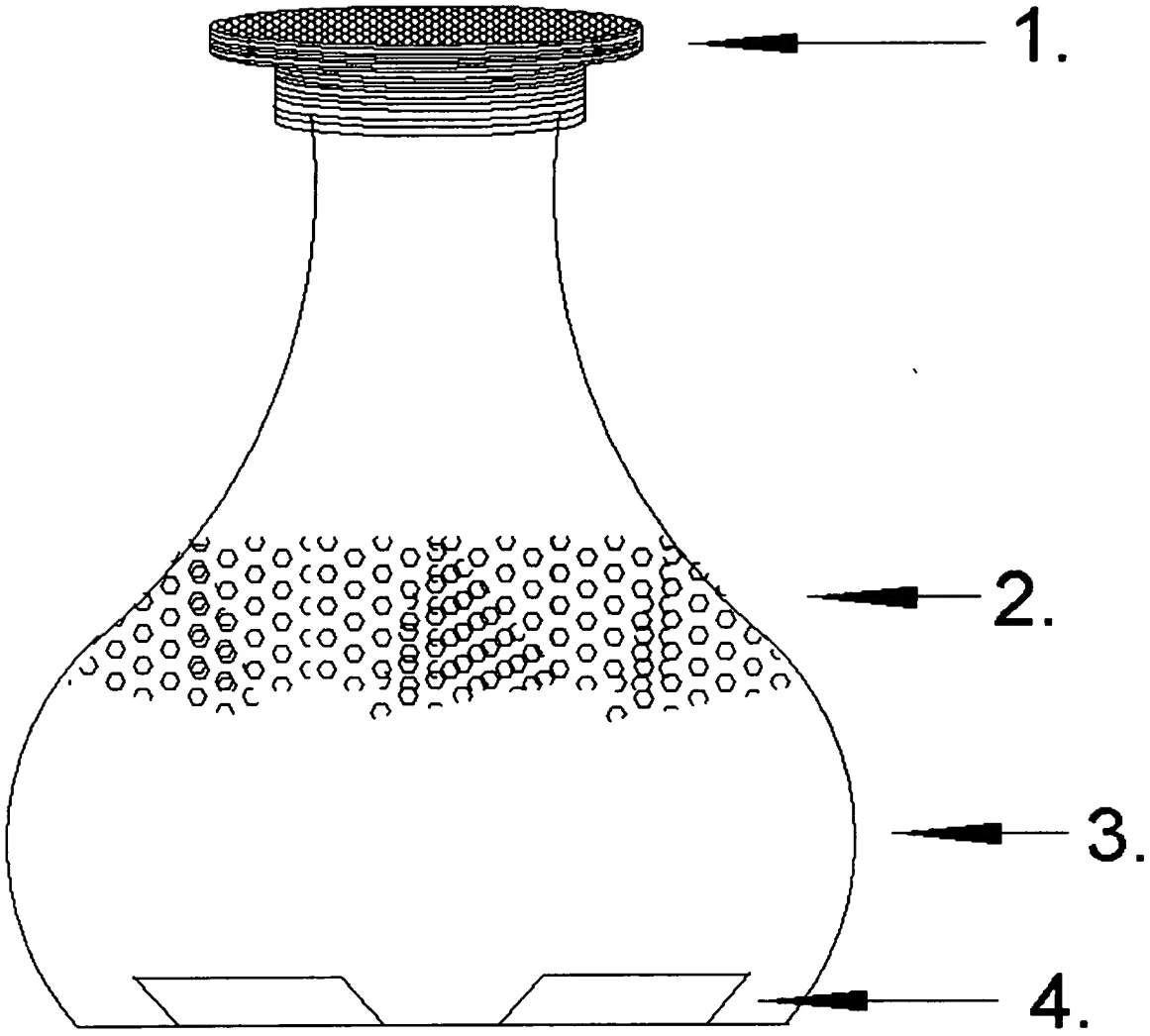



FIG.2

$$\begin{bmatrix} 100 \text{ grams sugar} \\ +\,3.75 \text{ grams ammonia} \\ +\,64.95 \text{ grams oxygen} \end{bmatrix} \Rightarrow \begin{bmatrix} 46.88 \text{ grams water} \\ +\,50.93 \text{ liters carbon dioxide} \\ +\,30 \text{ grams yeast} \end{bmatrix}$$

FIG.3

| Time During Fermentation | Yield (g cells/ g sugar) | Ammonia Needed (grams) | Water Produced (grams) | $CO_2$ Produced (liters) | Yeast Produced ($C_6H_{10}O_3N$) (grams dry wt.) | Ethanol Produced ($C_2H_6O$) (grams)* |
|---|---|---|---|---|---|---|
| 1st 3rd | .15 | 18.70 | 5.1 | 22.51 | 15.04 | 41.19 |
| 2nd 3rd | .052 | .65 | 1.79 | 25.54 | 5.20 | 47.68 |
| 3rd 3rd | .023 | .29 | .79 | 26.44 | 2.30 | 49.61 |
| Overall | .05 | .626 | 1.72 | 25.60 | 5.00 | 48.52 |

FIG.4

$$CO_2 \text{ solubility}(\text{in l } CO_2/\text{l } H_2O) = -1.06556266071 \times \ln(^\circ F) + 5.38424482284$$

FIG.5

$$\frac{\text{Change in yeast mass}}{\text{Change in time}} = \frac{\Delta X}{\Delta t} = \mu \times X$$

$$\ln\left[\frac{X}{X^{\circ}}\right] = \mu \times (t - t_{lag})$$

FIG.6

$$t_d = \frac{\ln (2)}{\mu}$$

FIG.7

$$\text{Ratio}\left[\frac{l\,CO_2}{g\,\text{sugar}}\right] = 0.271599039164 - (0.310674946821 \times \text{Yield})$$

FIG.8

$$\text{Specific Gravity} = (3.652010359\,96 \times 10^{-4}) \times S + 0.999953627005$$

FIG.9

$$Y = \frac{\Delta X}{\Delta S}$$

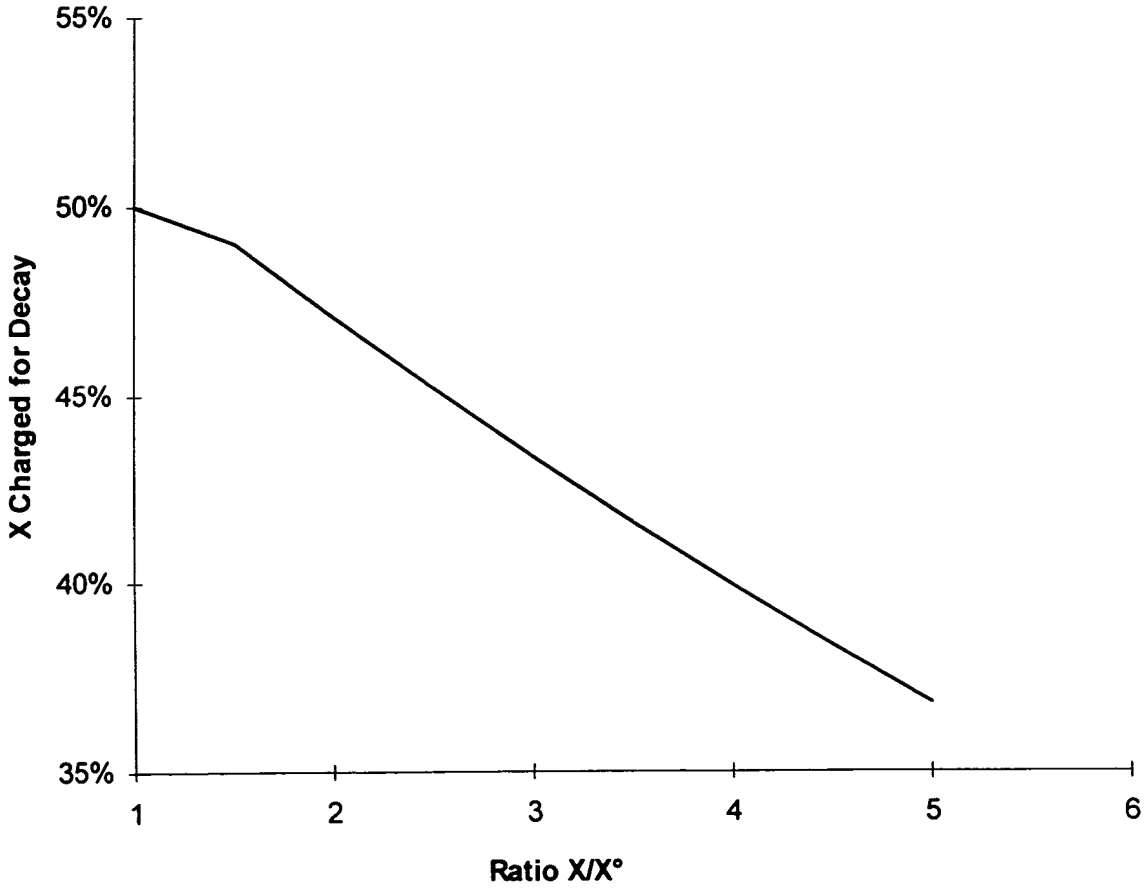
FIG.10

$$\left[\frac{\Delta X\,(for\ \text{decay})}{\Delta time}\right] = b \times X$$

FIG.11

$$Y = \left[\frac{\Delta X}{\Delta S}\right] = \left[\frac{5.14794}{24.644}\right] = 0.20889 \frac{gX}{gS}$$

FIG.12




$$Xchrgd = 0.504076447609 \times EXP(-0.0816252748703 \times Ratio)$$

FIG.13

| Sample Name | Time (hours) | X weight (grams) | S.G. Reading (g S/l, see EQSG) | Measured CO2 Flow (ml / min) |
|---|---|---|---|---|
| $t_0$ | 0 | 1.415 | 183.59 | 0 |
| $t_1$ | 15.75 | 2.73 | 178.11 | 3.944 |
| $t_2$ | 21.03 | 5.1 | 158.94 | 12.344 |
| $t_3$ | 24.5 | 6.18 | 147.99 | 15.074 |
| $t_4$ | 44.08 | 8.38 | 95.965 | 7.234 |

FIG.14

| A Interval | B Observed New X | C Total hours of interval | D Mass lost from starting X decay |
|---|---|---|---|
| $t_0 - t_1$ | 1.315 | 15.75 | 0.089145 |
| $t_1 - t_2$ | 2.37 | 5.28 | 0.0576576 |
| $t_2 - t_3$ | 1.08 | 3.2 | 0.06528 |
| $t_3 - t_4$ | 2.2 | 19.58 | 0.4840176 |

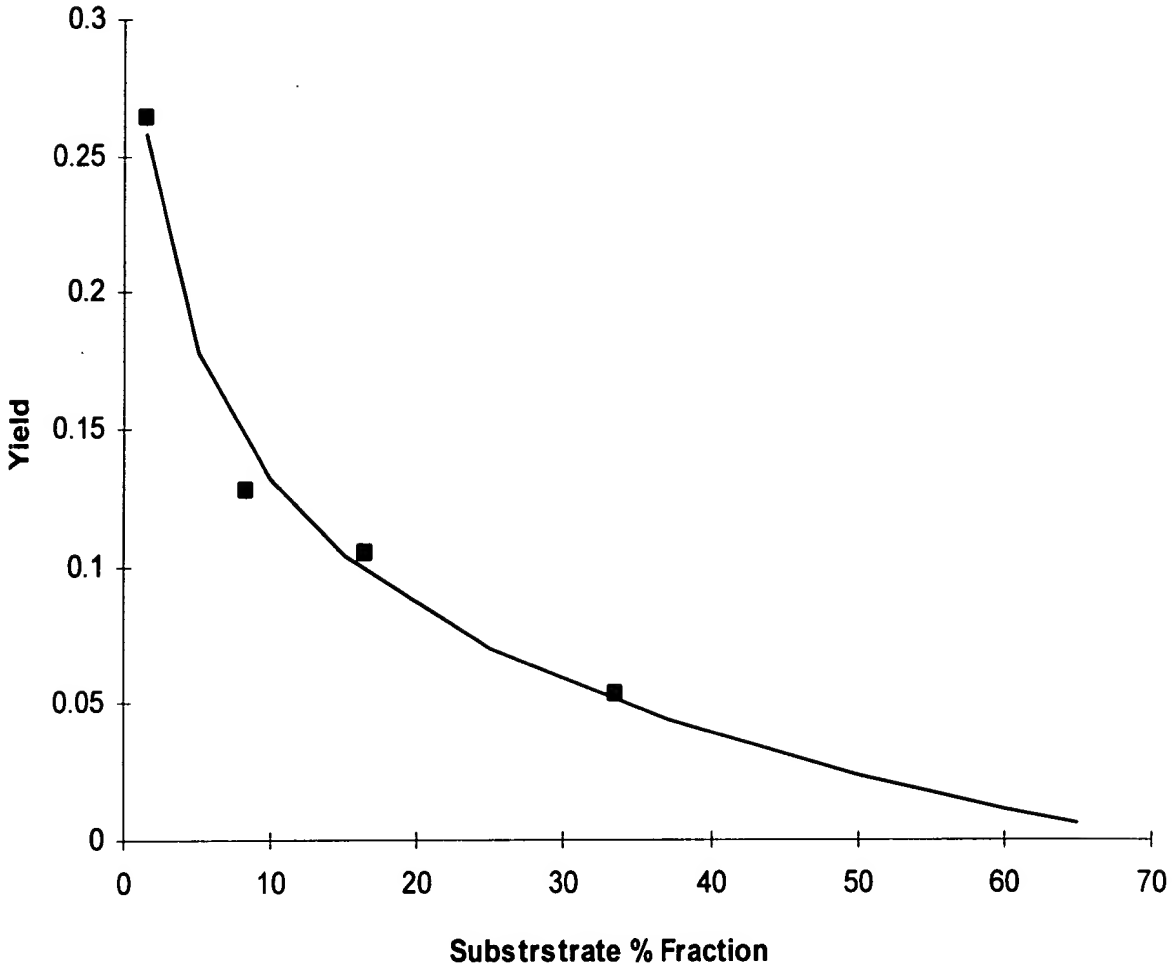
| A Interval | E Sub-total new mass (B + D) | F Ratio new X/Start X (Starting X + E) / Starting X | G Charge what new mass b? (EQXchrgd) |
|---|---|---|---|
| $t_0 - t_1$ | 1.404145 | 1.9923 | 0.471 |
| $t_1 - t_2$ | 2.4276576 | 1.88925 | 0.475 |
| $t_2 - t_3$ | 1.14528 | 1.22457 | 0.5 |
| $t_3 - t_4$ | 2.6840176 | 1.434307 | 0.493 |

| A Interval | H Decay of new mass (E x G x C x .004) | I Total new mass yield (E + H) | Amount of sugar used (g/l) |
|---|---|---|---|
| $t_0 - t_1$ | 0.0416652 | 1.4458102 | 5.48 |
| $t_1 - t_2$ | 0.024354261 | 2.45201186 | 19.17 |
| $t_2 - t_3$ | 0.007329792 | 1.152609792 | 10.95 |
| $t_3 - t_4$ | 0.103634643 | 2.7876522 | 52.025 |

| A Interval | J Average % S consumed | K Yield g X / g S | L Yield (fm curve) g X / g S |
|---|---|---|---|
| $t_0 - t_1$ | 1.4925 | 0.263833977 | 0.258098264 |
| $t_1 - t_2$ | 8.206 | 0.127908809 | 0.144275124 |
| $t_2 - t_3$ | 16.409 | 0.105261168 | 0.097997972 |
| $t_3 - t_4$ | 33.56 | 0.053582936 | 0.05021553 |

| A Interval | M % of actual Yield |
|---|---|
| $t_0 - t_1$ | 97.83% |
| $t_1 - t_2$ | 112.80% |
| $t_2 - t_3$ | 93.10% |
| $t_3 - t_4$ | 93.72% |

FIG.15




$$Y = \left\{-6.678143050038 \times 10^{-2} \times [\ln(\%\text{used})]\right\} + 0.284841059276$$

FIG.16

| Interval | % fraction of S | Yield fm EQ%used | Ratio fm EQYld (l $CO_2$/g X) |
|---|---|---|---|
| $t_0$ - $t_1$ | 1.4925 | 0.2580973 | 0.79324921 |
| $t_1$ - $t_2$ | 8.206 | 0.14427497 | 1.52663404 |
| $t_2$ - $t_3$ | 16.409 | 0.097998 | 2.3594534 |
| $t_3$ - $t_4$ | 33.56 | 0.0502161 | 5.00801093 |

| Interval | Total new X (grams) | liters $CO_2$ predicted fm model (g X x Ratio) | liters $CO_2$ predicted by actual Yield |
|---|---|---|---|
| | | | |
| $t_0$ - $t_1$ | 1.445803 | 1.1469 | 1.1192 |
| $t_1$ - $t_2$ | 2.452006 | 3.7433 | 4.2872 |
| $t_2$ - $t_3$ | 1.1526299 | 2.71968 | 2.5095 |
| $t_3$ - $t_4$ | 2.787623 | 13.9604 | 12.9849 |

| Interval | Average measured $CO_2$ (ml / min) | liters $CO_2$ predicted fm avg of measured $CO_2$ flow rate at this interval |
|---|---|---|
| | | |
| $t_0$ - $t_1$ | 1.972 | 1.8635 |
| $t_1$ - $t_2$ | 8.144 | 2.58 |
| $t_2$ - $t_3$ | 13.709 | 2.6321 |
| $t_3$ - $t_4$ | 11.154 | 13.1037 |

FIG.17